

Sequences and Series: Patterns That Add Up

Grade 11 – Algebra 2 math · Worksheet Answer Key · Standards: A-SSE.B.4, F-BF.A.2, F-IF.A.3

Every answer lists the rule or formula used and the arithmetic. If your result differs, check first whether you used n or $n - 1$, and whether the sum needs n terms.

Standards: A-SSE.B.4, F-BF.A.2, F-IF.A.3 · **Level:** Grade 11 Algebra 2

Problem 1 Classify the sequence

$9 - 14 = -5$, $4 - 9 = -5$, $-1 - 4 = -5$. **Arithmetic with $d = -5$; the next term is -6 .**

Problem 2 Explicit rule from a first term

$a_n = 11 + 6(n - 1) = 6n + 5$. Then $a_{12} = 77$. **$a_n = 6n + 5$; $a_{12} = 77$.**

Problem 3 Find the common ratio

$135 \div 405 = 1/3$ and $45 \div 135 = 1/3$. The next term is $45 \cdot 1/3$. **$r = 1/3$; next term 15.**

Problem 4 List terms from a recursive rule

$a_2 = 2(3) + 1 = 7$, $a_3 = 15$, $a_4 = 31$, $a_5 = 63$. **3, 7, 15, 31, 63.**

Problem 5 Arithmetic term from two terms

From 4 to 9 there are 5 steps adding 25, so $d = 5$. Then $a_1 = 17 - 3(5) = 2$. And $a_{30} = 2 + 29(5) = 147$. **$a_1 = 2$, $d = 5$, $a_{30} = 147$.**

Problem 6 Geometric term

$r = 18 \div 12 = 1.5$. $a_7 = 12 \cdot 1.5^6 = 12 \cdot 11.390625 = 136.6875$. **$a_7 = 136.6875$.**

Problem 7 Evaluate a sigma sum

The terms are 1, 4, 7, 10, 13 and $1 + 4 + 7 + 10 + 13 = 35$.

Problem 8 Geometric sigma sum

It is geometric with $a_1 = 2$, $r = 3$, $n = 6$. $S_6 = 2(1 - 3^6)/(1 - 3) = 2(-728)/(-2) = 728$.

Problem 9 Sum of an arithmetic series

$a_n = 6 + 4(n - 1) = 70$ gives $n = 17$. $S_{17} = 17(6 + 70)/2 = 646$. **646.**

Problem 10 Alternating geometric series

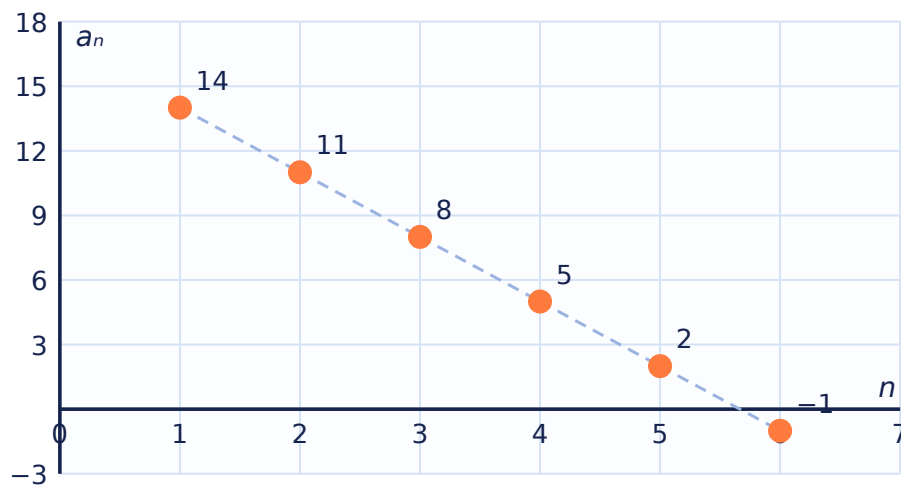
$r = -1.5$, so $S_5 = 8(1 - (-1.5)^5)/(1 - (-1.5)) = 8(8.59375)/2.5 = 27.5$. **27.5.**

Problem 11 Write sigma notation

The rule is $3k + 1$ (first term 4 at $k = 1$). Solve $3k + 1 = 40$ to get $k = 13$. $\sum_{k=1}^{13} (3k + 1)$.

Problem 12 Rule from a graph (arithmetic)

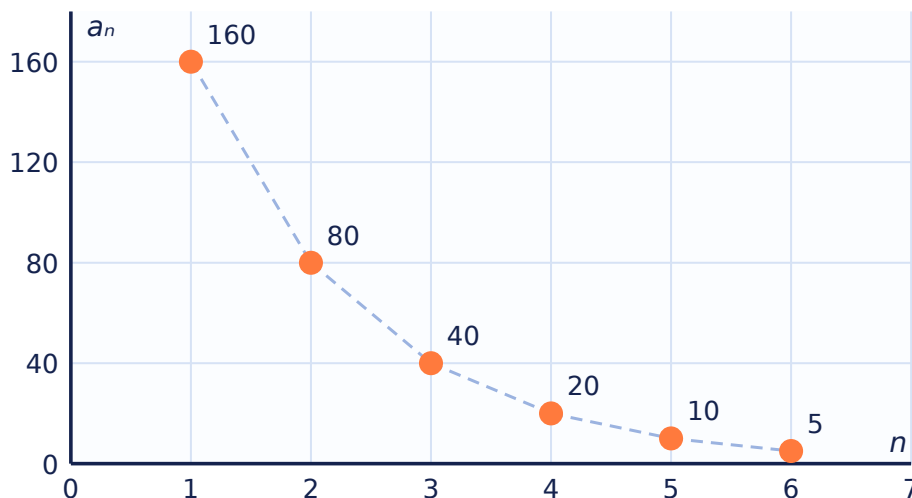
The terms drop by 3, so $d = -3$ and $a_1 = 14$. $a_n = 14 - 3(n - 1) = 17 - 3n$. **$a_n = 17 - 3n$.**



The rule continues: 2, -1, ...

Problem 13 Rule from a graph (geometric)

$80 \div 160 = 1/2$ and $40 \div 80 = 1/2$. **$r = 1/2$ and $a_n = 160(1/2)^{n-1}$.**



The next term is 5.

Problem 14 Number of terms

$3 \cdot 2^{n-1} = 1536$, so $2^{n-1} = 512 = 2^9$. Then $n - 1 = 9$. **$n = 10$.**

Problem 15 Theater seating

$a_{22} = 18 + 21(3) = 81$. $S_{22} = 22(18 + 81)/2 = 11 \cdot 99 = 1089$. **81 seats in row 22; 1089 seats in total.**

Problem 16 Monthly savings plan

The deposits grow to $200(1.005)^{23}$, ..., 200. So $S = 200 \cdot (1.005^{24} - 1)/(1.005 - 1) = 200 \cdot 25.4320$. $\approx$ **\$5,086.39**.

Problem 17 Salary with yearly raises

The yearly pay is geometric with $a_1 = 42000$, $r = 1.03$. $S_{10} = 42000(1.03^{10} - 1)/0.03 = 42000 \cdot 11.46388$. $\approx$ **\$481,483**.

Problem 18 Bouncing ball heights

Heights: 4.5, 3.375, ... The explicit rule is $h_n = 6(0.75)^n$, so $h_5 = 6 \cdot 0.237305 = 1.4238$. Recursive: $h_0 = 6$, $h_n = 0.75h_{n-1}$. $\approx$ **1.42 feet**.

Problem 19 Car loan payment

$r = 0.06/12 = 0.005$ and $n = 48$. $(1.005)^{-48} \approx 0.78710$, so the denominator is 0.21290. $M = 75/0.21290$. $\approx$ **\$352.28**.

Problem 20 Sum of odd numbers

The odd numbers are arithmetic with $a_1 = 1$ and $d = 2$, so $a_n = 2n - 1$. Then $S_n = n(1 + 2n - 1)/2 = n^2$. Since $49 = 2(25) - 1$, $n = 25$. **Sum = $25^2 = 625$.**